

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
14 June 2001 (14.06.2001)

(10) International Publication Number
WO 01/43444 A2

(51) International Patent Classification⁷: H04N 7/24

(74) Agents: BARNHARDT, Hubert, J., III et al.; Scientific-Atlanta, Inc., Intellectual Property Department (4.3.517), 5030 Sugarloaf Parkway, Lawrenceville, GA 30044 (US).

(21) International Application Number: PCT/US00/33518
(22) International Filing Date:
12 December 2000 (12.12.2000)

(81) Designated States (national): BR, CA, JP.

(25) Filing Language: English

(84) Designated States (regional): European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

(26) Publication Language: English

Published:

(30) Priority Data:
60/170,344 13 December 1999 (13.12.1999) US

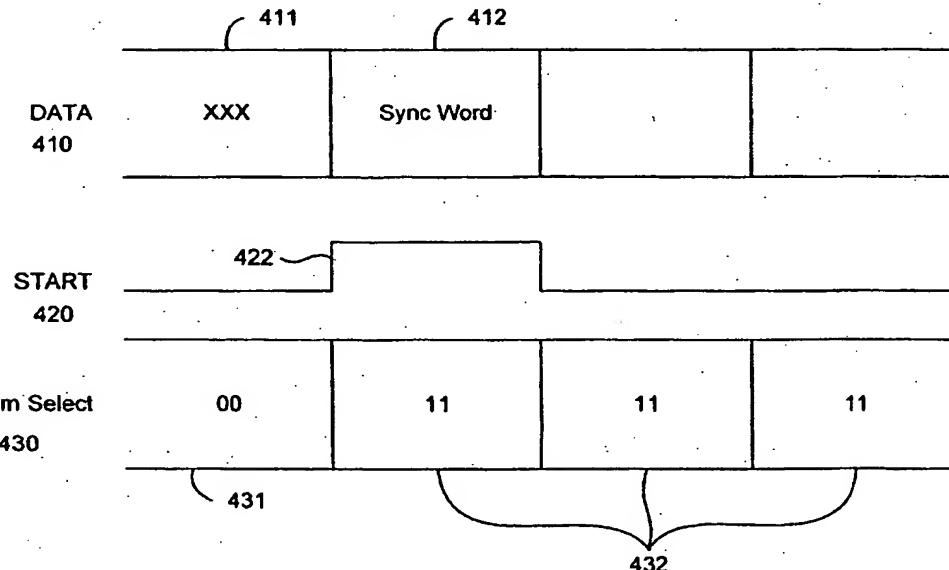
— Without international search report and to be republished upon receipt of that report.

(71) Applicant: SCIENTIFIC-ATLANTA, INC. [US/US];
Hubert J. Barnhardt III, Scientific-Atlanta, Inc., Intellectual Property Department, 5030 Sugarloaf Parkway, Lawrenceville, GA 30044 (US).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(72) Inventors: BACON, Kinney; 2820 Springtime Court,
Lawrenceville, GA 30043 (US). HAMMOND, Maynard;
732 Silver Falls Drive, Lawrenceville, GA 30045 (US).

(54) Title: METHOD OF IDENTIFYING MULTIPLE DIGITAL STREAMS WITHIN A MULTIPLEXED SIGNAL



WO 01/43444 A2

(57) Abstract: In a subscriber television system with a host terminal, the present invention allows the identification of the individual packets from two separate MPEG transport streams that have been multiplexed together for decoding by a single external conditional access or point-of-deployment (POD) module. The decoding of individual packets from two separate MPEG transport streams supports the use of multiple tuner host terminals for such functions as picture-in-picture (PIP) program viewing and the viewing of one program while recording a second program.

METHOD OF IDENTIFYING MULTIPLE DIGITAL STREAMS WITHIN A MULTIPLEXED SIGNAL

5

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority to U.S. Provisional Patent Application Number 60/170,344, Bacon et al., entitled *Method of Supplying Multiple Digital Streams to an External Conditional Access Module*, filed 13 December 1999, which is incorporated herein by reference.

FIELD OF THE INVENTION

This invention relates generally to decrypting multiple digital data streams in a subscriber television system, and more specifically to supplying multiple digital streams to an external conditional access or Point-of-Deployment (POD) module for decryption.

BACKGROUND OF THE INVENTION

Historically, a subscriber television system operator provides a subscriber with a set-top terminal that allows the subscriber to receive and decrypt television programs and services. The set-top provides access to the subscriber television system, including providing conditional access for the specific subscriber television system. The subscriber television system uses conditional access to prevent unauthorized users from pirating or accessing the system services. A system subscriber "rented" the set-top from the subscriber television system by paying a monthly fee. Subscriber's returned the set-top when they moved or changed service providers.

The Telecommunications Act of 1996, which is being implemented by the Federal Communications Commission (FCC), allows subscribers to buy a host terminal, also known as a consumer set-top terminal, from a variety of sources for use in any subscriber television system. The host terminal may be integrated into a videocassette recorder (VCR), television (TV), computer, or other similar device.

The operator of each subscriber television system has the responsibility of providing an interface for this subscriber owned equipment that allows it to function with the individual subscriber television system. To address the concern of the subscriber television system operators about conditional access and piracy, the FCC directed the Society of Cable Television Engineers (SCTE) to establish standards for what is referred to as an external conditional access module or a Point-of-Deployment (POD) module. The POD module provides a removable conditional access element for a host terminal. A POD module is provided by the individual subscriber television

system and upon insertion into a host terminal, and upon receiving proper authorization, allows the decryption of encrypted conditional access services to prevent piracy. A POD module conforms generally to the Personal Computer Memory Card International Association (PCMCIA) standards. The POD module is typically a little larger than a credit card, is inserted into a slot in a host terminal, and communicates with the host terminal via a PCMCIA connector. The POD module would be removed from the host terminal and returned to the subscriber television system when the subscriber moves or changes service providers. The subscriber would get a new POD module from the next subscriber television system to which they elect to subscribe for services.

The subscriber television systems provide a large quantity of programs and services. The programs and services are typically provided to the subscriber via transport streams within a transmission signal. There can be multiple programs or services within a single transport stream and multiple transports streams within the transmission signal. A host terminal that wants to simultaneously display programming from two separate transport streams would use two tuners, one for each transport stream. This creates a problem in that there is the possibility that two transport streams need to be decrypted for conditional access. The SCTE specification limits the number of data streams that can be input at one time into a POD module to one. On a host terminal with Picture-in-Picture (PIP) functionality that requires two inputs, the host terminal would not be able to simultaneously decrypt the two data streams to provide both the main and the secondary picture data. A host terminal with multiple data streams, such as those with two or more tuners, must limit the decryption to one data stream from one tuner. The system subscriber that owns a host terminal with multiple tuners will want to use the functionality that is provided with those elements, such as PIP or the simultaneous taping and viewing of different programs. The operator of a subscriber television system needs to be able to provide a POD module that is capable of receiving multiple data streams for decryption to support the multiple tuner functionality. Thus, what is needed is a method, host terminal, and external conditional access module that allows the decryption of multiple data streams to support a multiple data stream host terminal.

BRIEF DESCRIPTION OF THE DRAWINGS

30 FIG. 1 is a block diagram of a subscriber television system.
FIG. 2 is a block diagram of a host terminal.
FIG. 3 is a block diagram view of the functional components of an external conditional access module.
35 FIG. 4 is an illustration of a packetized data signal with a start of packet signal and a transport stream source indicator signal.

FIG. 5 is a detailed block diagram view of the functional components of an external conditional access module.

DETAILED DESCRIPTION

5 The present invention is directed to a method, host terminal, and external conditional access module that enable the decryption of portions of multiple packetized data streams associated with a multiple tuner host terminal.

10 The available functionality can vary widely between different host terminals, based on several factors. The available functionality may vary based on cost and manufacturer of the host terminal

15 or based on the support provided by the local subscriber television system. A less expensive host terminal would typically have less functionality. The host terminal may include the equipment need to perform a function, but if an individual subscriber television system does not allow or support a function the subscriber may not be able to access the function. For example, a host terminal may have multiple tuners to support picture-in-picture (PIP) video display, but if the

20 subscriber television system does not allow or support PIP, a subscriber may not be able to use the functionality available in their host terminal. Conditional access is one method a system operator can use to control the functionality available within an individual subscriber television system.

25 With conditional access, a subscriber needs authorization to access some or all of the programs or services. An external conditional access module or point-of-deployment (POD) module controls

30 the conditional access of the subscriber to the programming and services of the subscriber television system. The system operator provides the external conditional access module that a subscriber inserts into their host terminal. The host terminal would normally transmit data packets for a subscriber-selected program to the external conditional access module for decryption. The host terminal would also typically transmit a data clock or start signal that indicates the start of 25 each of the data packets. The external conditional access module determines if the subscriber is authorized to receive a selected program and, if authorized, decrypts the data packets for that program. The decrypted data packets can then be decoded and displayed to the subscriber.

35 The advent of picture-in-picture capabilities and the desire to be able to record one program while viewing another requires the ability to perform conditional access on packets from multiple

40 packetized data streams without adding a second external conditional access module. Multiple data streams provide data for two or more programs to be displayed simultaneously. The present invention allows the identification, by a single POD module, of the individual packets from two or more separate MPEG transport streams that have been multiplexed together for decrypting. The POD module, knowing the source of the individual packet, can determine if the packet is

45 authorized to be decrypted for the individual subscriber and the correct decryption parameters to apply to decrypt each packet.

The present invention will be described more fully hereinafter with reference to the accompanying drawings in which like numerals represent like elements throughout the several figures and in which exemplary embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the 5 embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. The present invention is best understood within the context of a subscriber television system. Referring now to the drawings, a subscriber television system and exemplary embodiments of the present invention will be described.

10 FIG. 1 shows a block diagram view of a subscriber television system 10, including a Host Terminal 14. Generally, the subscriber television system 10 is a high quality, reliable and integrated network system that features video, audio, voice, and data services to subscribers. Although FIG. 1 depicts a high level view of a subscriber television system including a regional Hybrid Fiber/Coax (HFC) Access Network 38, as will be described below, it should be 15 appreciated that a plurality of subscriber television systems can tie together a plurality of regional networks into an integrated global network so that subscribers can receive content provided from anywhere in the world. The subscriber television system 10 shown in FIG. 1 delivers broadcast video signals as digitally formatted signals in addition to delivering traditional broadcast analog video signals. Furthermore, the system can support one way broadcast services as well as both 20 one-way data services and two-way media and data services. The two-way operation of the network allows for subscriber interactivity with services, such as Pay-Per-View programming, View-on-Demand programs, and interactive applications, such as Email, Internet connections, and EPG applications.

25 The subscriber television system 10 provides the interfaces, network control, transport control, session control, and servers to access content and services, and distributes content and services to subscribers. As shown in FIG. 1, a typical subscriber television system 10 is composed of interfaces to Content Providers 18, Network Operations Centers (NOC) 22, core networks 30 of headends 26, hubs 34, HFC Access Networks 38, and subscribers' host terminals 14. It should be appreciated that although single components (e.g., headend 26, core network 30, HFC Access 30 network 38, etc.) are illustrated in FIG. 1, a subscriber television system 10 can feature a plurality of each of the illustrated components.

35 The Content Provider 18 represents one or more providers of content, such as video channels, music channels, data channels, video services, audio services, and data services. For example, the Content Provider 18 could comprise an Electronic Program Guide (EPG) data provider that acts as a data service provider. The Content Provider 18 could also represent an Internet Service Provider (ISP) providing data to the system to enable subscribers' web access or web-enhanced

video via the subscriber's television set. The Content Provider 18 transmits the content to a headend 26 for further transmission to subscribers downstream in the network. Also in communication with the headend 26 is a Network Operation Center (NOC) 22, which is an external management center, interfaced with the subscriber television system 10 to allow for the remote operation of the system.

Content provided by the Content Provider 18 is communicated to one or more headends 26. From those headends 26 the content is then communicated to the core network 30 of hubs 34 and onto a plurality of HFC Access Networks (only one HFC Access Network 38 is illustrated). The HFC Access Network 38 typically comprises a plurality of HFC nodes 42, each of which may service a local geographical area. The content provided from the Content Provider 18 is transmitted through the headend 26, hub 34 and HFC Access Network 38 downstream to one or more taps 46 from each one of the HFC nodes 42 of the HFC Access Network 38. The hub 34 connects to the HFC node 42 through the fiber portion of the HFC Access Network 38. Usually, the HFC node 42 connects to a subscriber's host terminal 14 through coaxial cable in a logical tree configuration, which is where the optical-to-electrical and electrical-to-optical conversations of the HFC network take place. From the HFC node 42 a coaxial drop connects the tap 46 to a subscribers' home.

FIG. 2 is a block diagram view of a host terminal 14. The host terminal 14 receives the incoming radio frequency (RF) signal 210 from the subscriber television system 10. The signal is available to the multiple tuners 210 and 211 and to the out-of-band (OOB) receiver 215 and transmitter 216. The OOB signaling provides an alternative communications path within the subscriber television system 10. Control, signaling, and return communications are typically communicated using the OOB signaling. The host terminal 14 includes a central processing unit (CPU) 230 for controlling the host terminal 14 and the POD interface 225. The host terminal 14 contains all the normal circuitry required to function as a set-top terminal (STT) or home communications terminal (HCT) including a power supply 270, an LED display 265, an infrared (IR) receiver 260, a keypad 261, an output modulator 250, an MPEG decoder 240, a graphics generator 241, a DRAM 242, a Flash 235, and other support circuitry. This host terminal 14 also includes two independent tuners, tuner 210 and tuner 211, and is capable of receiving and tuning two separate, encrypted packetized data streams. The present invention assigns a unique designator or address to each tuner to be used in identifying the source of packetized data. Additionally, the host terminal 14 contains the circuitry required to interface to a POD module, which uses the POD interface 225 and a PCMCIA PC Card connector. The typical POD 225 interface specification is described in the Society of Cable Telecommunications Engineers, Inc., Engineering Committee, Digital Video Subcommittee Document SCTE DVS/295, entitled "Proposed HOST-POD Interface Specification", dated January 7, 2000, which is incorporated

herein by reference. The POD interface 225 of the present invention includes additional or modified elements to support decrypting packetized data from multiple sources. A multiplexer 226 and a demultiplexer 227 are included. The multiplexer 226 multiplexes together select portions of the separate signals it receives from each tuner and generates a unique designator 5 signal indicating the originating tuner for each portion of the multiplexed signal. The demultiplexer 227 takes the returned signal from a POD module and separates it into demultiplexed signals associated with each tuner.

FIG. 3 is a block diagram view of the functional components of an external conditional access module 310. The external conditional access module or point-of-deployment (POD) module 310 is inserted into the subscriber's host terminal 14. The specifications of the POD module 310 are 10 described in the Society of Cable Telecommunications Engineers, Inc., Engineering Committee, Digital Video Subcommittee Document SCTE DVS 131; Rev. 7, entitled "*Draft Point-of-Deployment (POD) Module Interface Proposal*", dated December 3, 1998, which is incorporated herein by reference. The POD module 310 interfaces to the POD interface 225 of FIG. 2, 15 including the multiplexer 226 and the demultiplexer 227.

In an exemplary embodiment the data stream is a Moving Picture Experts Group (MPEG) transport stream. The present invention is not so limited and can be used to identify multiplexed portions of other types of data streams, including identifying the source of different portions of a multiplexed signal associated with two separate data bit streams or with packetized data streams. 20 The packetized data streams can include formatted data such as Internet Protocol (IP), MPEG-4, and asynchronous transfer mode (ATM) formatted data. In this exemplary embodiment, MPEG refers to the MPEG-1 and MPEG-2 standards. The MPEG-1 standards (ISO/IEC 11172) and the MPEG-2 standards (ISO/IEC 13818) are described in detail in the International Organization for Standardization document ISO/IEC JTC1/SC29/WG11 N (June 1996 for MPEG-1 and July 1996 25 for MPEG-2), which are hereby incorporated by reference.

The multiplexer 226, of host terminal 14, takes MPEG Data 1 and MPEG Data 2 from their respective sources and multiplexes the two data streams together to create the Multiplexed MPEG Data. The multiplexer 226 transmits the multiplex of multiple complete transport streams to the POD module 310. The MPEG Data 1 and MPEG Data 2 can be a variety of data and data formats, 30 including a bit stream, a packetized data stream, IP data, and individual MPEG transport streams with audio, video, and data packets. The multiplexing can be performed based on a variety of data unit sizes, including data unit sizes of a bit, a byte, or a packet.

An MPEG transport stream can contain data packets for multiple programs. In an alternative embodiment, the multiplexer 226 determines the packet identification (PID) for the packets 35 related to a selected program within the transport streams from each source and then multiplexes

together the desired program associated packets based on the associated PIDs. In this alternative embodiment, only the desired packets are transmitted to the POD module 310.

Referring to FIG. 4, the Data or Multiplexed MPEG Data stream signal 410 is the multiplex of the MPEG Data 1 and MPEG Data 2 data streams. The Start or MPEG Start signal 420 indicates the start of an MPEG packet with a signal level change 422 and is associated with the synchronization (sync) word 412 in the header of an MPEG packet. In an alternative embodiment, the Start signal 420 indicates a bit or byte of data. The Stream Select or transport stream source indicator signal 430 indicates the source of the associated portion of the signal, portions including bits, bytes, or packets. For example, the packets starting with the packet containing sync word 412 are associated with the MPEG Data 1 source assigned the unique designator "11" 432 and the prior packet 411 would be associated with the MPEG Data 2 source assigned the unique designator "00" 431. In addition to the Multiplexed MPEG Data stream signal 410, the multiplexer 226 transmits the MPEG Start signal 420 and the Stream Select signal 430 signal to the POD module 310. The MPEG Start signal 420 is associated with the MPEG clocks signals of the MPEG Data 1 and MPEG Data 2 data streams.

Referring again to FIG. 3, the POD module 310 receives the Data stream signal 410, the MPEG Clock signal 420, and a Stream Select signal 430 in the POD Demultiplexer 330. The demultiplexer 330 identifies the portions of the Data stream signal 410 as packets from each unique source (MPEG Data 1 or MPEG Data 2) based on the Stream Select signal 430. The source-associated packets of the Data stream signal 410 are transmitted to a source-associated decryptor, either decryptor 340 or decryptor 345, for decryption. The Conditional Access Control 360 determines if the subscriber is authorized to have the source-associated data decrypted. If the subscriber is authorized to receive the selected program or service, the Conditional Access Control 360 instructs decryptor 340 or decryptor 345 as to the proper decryption to use for decrypting the selected program associated data. This means that data associated with both, either, or neither source may be decrypted. If the decision is made to authorize decryption, the authorized source associated data will pass through a decryptor, otherwise the decryptor is bypassed. The selected program packets from decryptor 340 and decryptor 345 are transmitted to POD Multiplexer 350 to be recombined into a Multiplexed MPEG Data signal. The packets may be decrypted if the subscriber was authorized to receive the packet associated program or service. The data can still be encrypted if the subscriber was not authorized to receive the associated programming or service. The Multiplexed MPEG Data signal, with the recombined data of the source associated packets, is transmitted back to the demultiplexer 227 of the host terminal 14. The demultiplexer 227 uses the Stream Select signal 430 to separate the Multiplexed MPEG Data signal back into post-decryption tuner associated signals MPEG Data 1' and MPEG Data 2', with associated MPEG Start signals. The MPEG Data 1' and MPEG Data 2' signals are related to the

initial MPEG Data 1 and MPEG Data 2 signals. The host terminal 14 uses the decrypted signals to cause the display of programming associated with a first tuner, the MPEG Data 1' signal, as a primary picture and the programming associated with a second tuner, the MPEG Data 2' signal, as a secondary picture for a PIP function. Those skilled in the art will appreciate that the order of 5 the PIP pictures can be reversed and that the separately identified signaling can be used for other purposes such as recording one program while continuing to view another program.

FIG. 5 is a detailed functional block diagram of the POD module 310 of the present invention. In another exemplary embodiment, the POD module 310 contains a PCMCIA connection 505 through which MPEG transport streams are received by PCMCIA/POD interface 510, 10 demultiplexed by MPEG Transport Demultiplexor 512, decrypted if the conditional access control allows by Core Decryptor 514, re-encrypted for copy protection by Encryptor 516, multiplexed back together by MPEG Transport Multiplexor 518, and transmitted to the host terminal 14 by PCMCIA/POD interface 510. Additionally, the POD module 310 contains circuitry, OOB Physical 522 and OOB MAC Filters 524, for receiving of Out-of-Band (OOB) signals in the 15 MPEG transport stream. The OOB signaling is used for transmitting Entitlement Management Messages (EMM) that determine if conditional access to selected programming and services is granted or allowed. The Central Processing Unit (CPU) 530 controls and monitors the functions of the POD module 310 and accesses Flash memory 560 and Dynamic Random Access Memory (DRAM) 570 through the Memory Controller 550. A Secure Microprocessor 580 is utilized to 20 receive and control the EMM as well as the Entitlement Control Message (ECM). The ECM is used to verify the EMMs. The EMMs and ECM together provide the information required to determine if the subscriber is entitled to access the digital video/audio stream and for the POD module 310 to perform the decryption. A Non-Volatile Memory (NVM) 590 is used to store non-secure system parameters.

25 The outputs of the two tuners, tuner 210 and tuner 211, in the host terminal 14 are two separate independent signals. The independent signals are passed through multiplexor 226 in the host terminal 14 that synchronizes them and combines them into a single data stream 410 that is sent through the modified POD interface 510 using the MPEG input stream select signal 430 to indicate the source of the active or current packetized data. The multi-stream capable POD 30 module 310 demultiplexes these signals and uses the conditional access circuitry (internal secure microprocessor 580) to independently determine if the POD module 310 is authorized to decrypt the packetized data from each stream. This means that packetized data from both, either, or neither stream may be decrypted. If the decision is made to authorize decryption, the authorized packetized data will pass through a decryptor, otherwise the decryptor is bypassed. In one 35 embodiment, if the packetized data was decrypted, that data will be re-encrypted to provide copy protection between the POD module 310 and the host terminal 14. The two packetized data

streams will then be multiplexed back together and transmitted to the host terminal 14. The host terminal 14 demultiplexes the streams and performs the desired user function such as picture-in-picture or taping one video/audio stream while viewing another.

One advantage of the present invention is the minimization of the number of connections required between the host terminal 14 and the POD module 310 for processing multiple packetized data streams. Utilizing the same input and output signals prevents the interface from requiring a larger connection. The POD module 310 uses 68-connector pins in the interface. There are 6 unused signals (A13-A10, A3-A2) in a standard POD module configuration. Other methods could require an additional 18 signals and a total of 12 extra connector pins to add a single additional digital video/audio stream. With the present invention, only two extra signals are required for the multiplex selection or Stream Select signal 430. No extra connector pins are required. In an embodiment using the 6 unused POD module 310 signals (3 for input, 3 for output), portions of up to 8 packetized data streams can be multiplexed together.

An exemplary embodiment of the present invention modifies the standard POD interface to change the A12 signal to the input stream select signal and the A13 signal to the output stream select signal. The POD module 310 initializes in a PCMCIA mode compatible with the PCMCIA standards. After initialization the POD module 310 functions in an external conditional access mode. The pin assignments of the PCMCIA/POD interface 510 between the host terminal 14 and the POD module 310 of an exemplary embodiment of the present invention are as follows:

20

Table 1. PCMCIA/POD pin assignments

Pin	PCMCIA Signal Name	I/O	POD Signal Name	I/O	Comments
1	Ground	Power	Ground	Power	Ground
2	Data 3	I/O	Data 3	I/O	Data bit 3
3	Data 4	I/O	Data 4	I/O	Data bit 4
4	Data 5	I/O	Data 5	I/O	Data bit 5
5	Data 6	I/O	Data 6	I/O	Data bit 6
6	Data 7	I/O	Data 7	I/O	Data bit 7
7	CE1#	I	CE1#	I	Card enable 1
8	Address 10	I	Address 10	I	Address bit 10
9	OE#	I	OE#	I	Card output enable
10	Address 11	I	Address 11	I	Address bit 11
11	Address 9	I	DRX	I	Receiver data
12	Address 8	I	CRX	I	Receiver gapped clock
13	Address 13	I	MOSS	I/O	MPEG Output Stream Select

14	Address 14	I	MCLK0	O	MPEG clock output
15	WE#	I	WE#	I	Write enable
16	READY/IREQ#	O	IREQ#	O	Interrupt request
17	Vcc	Power	Vcc	Power	3.3V
18	Vpp1	Power	Vpp1	Power	5V-Switched
19	Address 16	I	MIVAL	I	MPEG input valid
20	Address 15	I	MCLK1	I	MPEG input clock
21	Address 12	I	MISS	I	MPEG Input Stream Select
22	Address 7	I	QTX	O	Transmitter Q channel
23	Address 6	I	ETX	O	Transmitter enable
24	Address 5	I	ITX	O	Transmitter I channel
25	Address 4	I	CTX	I	Transmitter gapped clock
26	Address 3	I	Address 3	I	Address bit 3
27	Address 2	I	Address 2	I	Address bit 2
28	Address 1	I	Address 1	I	Address bit 1
29	Address 0	I	Address 0	I	Address bit 0
30	Data 0	I/O	Data 0	I/O	Data bit 0
31	Data 1	I/O	Data 1	I/O	Data bit 1
32	Data 2	I/O	Data 2	I/O	Data bit 2
33	WP/IOIS16#	O	IOIS16#	O	16-bit I/O (always high)
34	Ground	Power	Ground	Power	Ground
35	Ground	Power	Ground	Power	Ground
36	CD1#	O	CD1#	O	Card detect 1
37	Data 11	I/O	MDO3	O	MPEG data out bit 3
38	Data 12	I/O	MDO4	O	MPEG data out bit 4
39	Data 13	I/O	MDO5	O	MPEG data out bit 5
40	Data 14	I/O	MDO6	O	MPEG data out bit 6
41	Data 15	I/O	MDO7	O	MPEG data out bit 7
42	CE2#	I	CE2#	I	Card enable 2
43	VSI#/Refresh	O	VSI	O	Voltage sense 1
44	IORD#	I	IORD#	I	I/O Read
45	IOWR#	I	IOWR#	I	I/O Write
46	Address 17	I	MISTRT	I	MPEG input start
47	Address 18	I	MDI0	I	MPEG data in bit 0
48	Address 19	I	MDI1	I	MPEG data in bit 1
49	Address 20	I	MDI2	I	MPEG data in bit 2
50	Address 21	I	MDI3	I	MPEG data in bit 3
51	Vcc	Power	Vcc	Power	3.3V
52	Vpp2	Power	Vpp2	Power	5V-Switched

53	Address 22	I	MDI4	I	MPEG data in bit 4
54	Address 23	I	MDI5	I	MPEG data in bit 5
55	Address 24	I	MDI6	I	MPEG data in bit 6
56	Address 25	I	MDI7	I	MPEG data in bit 7
57	VS2#	O	VS2#	O	Voltage Sense 2
58	RESET	I	RESET	I	Card reset
59	WAIT#	O	WAIT#	O	Extend bus cycle
60	INPACK#	O	INPACK#	O	Input port ack
61	REG#	I	REG#	I	Register select
62	BVD2/SPKR#	O	MOVAL	O	MPEG data out valid
63	BVD1/STSCHG#	O	MOSTRT	O	MPEG data out start
64	Data 8	I/O	MDO0	O	MPEG data out bit 0
65	Data 9	I/O	MDO1	O	MPEG data out bit 1
66	Data 10	I/O	MDO2	O	MPEG data out bit 2
67	CD2#	O	CD2#	O	Card detect 2
68	Ground	Power	Ground	Power	Ground

Those skilled in the art will recognize that the pin assignments could be changed, adjusted, expanded, or reduced and that alternate implementations are included within the scope of the present invention.

5 Although the present invention has been described in one embodiment as allowing the decryption of multiple packetized data streams in a POD module 310, those skilled in the art will recognize that the unique designator and the Stream Select signal 430 can be used to allow multi-tasking of multiple packetized data streams by other components, such as the MPEG Decoders 240 of host terminal 14. In one embodiment the host terminal 14 Demultiplexer 227 would not be
10 needed, as a modified MPEG Decoders 240 could interface with the multiplexed data signal 410.

15 The unique designator is not to be confused with a packet identifier (PID). The PID is associated with the packet and identifies all packets with the same type of data associated with a particular program or service. For example, the video packets associated with the television program for channel 12 will all have the same PID. The unique identifier of the present invention is associated with the source of the portion of the multiplexed signal for the packetized data.

20 In addition, those skilled in the art will recognize that to provide PIP or multiple recording options for multiple programs within the same transport stream, two or more of the multiple tuners could be tuned to the same transport stream. The present invention separately identifies the packetized data signals based on the tuner or source providing the input, even if the input signals to the tuners is identical.

Those skilled in the art will recognize that the elements herein described in the POD module 310 and the host terminal 14 can be used for multiple functions and in various combinations within the scope of the present invention. For example, the Encryptor 516 can provide encryption for a variety of reasons including for copy protection and to prevent signal piracy between the 5 POD module 310 and the host terminal 14.

The terms encryption and decryption are intended to include encryption and decryption and the scrambling and unscrambling of data, including audio and video signals. Scrambling is the disarrangement of the elements of a transmission in order to make it unintelligible to anyone without an authorized receiver.

10 It should be emphasized that the above-described embodiments of the present invention are merely possible examples of the implementations, set forth for a clear understanding of the principles of the invention. Many variations and modifications may be made to the above-described embodiments of the invention without departing substantially from the spirit of the principles of the invention. All such modifications and variations are intended to be included 15 herein within the scope of the disclosure and the present invention and protected by the following claims.

What is claimed is

- 1 1. In a system with a plurality of packetized data streams, a method of designating a source of at
2 least one packetized data stream within a multiplexed signal including at least a portion of the at least
3 one packetized data stream, the method comprising the steps of:
 - 4 assigning a unique designator to the source of the at least one packetized data stream;
 - 5 multiplexing at least the portion of the at least one packetized data stream with at least a
6 portion of a second packetized data stream to create the multiplexed signal; and
 - 7 transmitting the unique designator in conjunction with the multiplexed signal, wherein
8 transmission of the unique designator indicates the source of the portion of the multiplexed signal as
9 the source of the at least one packetized data stream.
- 1 2. The method of claim 1, wherein the packetized data stream is in a format compliant with one
2 of Moving Picture Experts Group type 2 (MPEG-2) standard, Moving Picture Experts Group type 4
3 (MPEG-4) standard, Asynchronous Transfer Modulation (ATM) standard, and Internet Protocol (IP)
4 standard.
- 1 3. The method of claim 1, wherein the step of transmitting the unique designator comprises the
2 steps of:
 - 3 creating a unique designator signal that includes the unique designator; and
 - 4 transmitting the unique designator signal in conjunction with the multiplexed signal, wherein
5 the unique designator signal provides the unique designator at the start of the at least one packet of the
6 at least one packetized data stream.
- 1 4. The method of claim 1, wherein the step of transmitting the unique designator comprises the
2 steps of:
 - 3 creating a unique designator signal that includes the unique designator; and
 - 4 transmitting the unique designator signal in conjunction with the multiplexed signal, wherein
5 the unique designator signal provides the unique designator at the start of the at least one byte of the at
6 least one packetized data stream.

1 5. In a system with a plurality of packetized data streams, a method of designating to an external
2 conditional access module a source of at least one packetized data stream within a multiplexed signal
3 including at least a portion of the at least one packetized data stream, the method comprising the steps
4 of:

5 assigning a unique designator to the source of the at least one packetized data stream;
6 multiplexing at least the portion of the at least one packetized data stream with at least a
7 portion of a second packetized data stream to create the multiplexed signal; and
8 transmitting the unique designator in conjunction with the multiplexed signal to the external
9 conditional access module, wherein transmission of the unique designator indicates the source of the
10 portion of the multiplexed signal as the source of the at least one packetized data stream.

1 6. The method of claim 5, wherein the packetized data stream is in a format compliant with one
2 of Moving Picture Experts Group type 2 (MPEG-2) standard, Moving Picture Experts Group type 4
3 (MPEG-4) standard, Asynchronous Transfer Modulation (ATM) standard, and Internet Protocol (IP)
4 standard.

1 7. The method of claim 5, wherein the step of transmitting the unique designator comprises the
2 steps of:
3 creating a unique designator signal that includes the unique designator; and
4 transmitting the unique designator signal in conjunction with the multiplexed signal to the
5 external conditional access module, wherein the unique designator signal provides the unique
6 designator at the start of the at least one packet of the at least one packetized data stream.

1 8. The method of claim 5, wherein the external conditional access module decrypts the at least
2 one packet of the at least one packetized data stream based on the source of the at least one packetized
3 data stream indicated by the unique designator.

1 9. In a host terminal, a method of multiplexing together packets from at least two packetized
2 data streams to enable decryption of the packets by an external conditional access module, the method
3 comprising the steps of:

4 assigning a unique designator to each originating packetized data stream of the at least two
5 packetized data streams;

6 multiplexing the packets forming portions of the at least two packetized data streams into a
7 signal;

8 creating an association for each packet in the signal with the unique designator of the
9 originating packetized data stream from which each packet originated;

10 transmitting the signal and the associations of the packets to the external conditional access
11 module; and

12 decrypting, in the external conditional access module, the packets in the signal based on the
13 originating packetized data stream as indicated by the associated unique designator.

1 10. The method of claim 9, wherein the at least two packetized data streams are in a format
2 compliant with one of Moving Picture Experts Group type 2 (MPEG-2) standard, Moving Picture
3 Experts Group type 4 (MPEG-4) standard, Asynchronous Transfer Modulation (ATM) standard, and
4 Internet Protocol (IP) standard.

1 11. In a system with a plurality of Moving Picture Experts Group type 2 (MPEG-2) standard
2 transport streams and a host terminal, a method of designating to an external conditional access
3 module a source of at least one packet of a first MPEG-2 transport stream within a multiplexed signal
4 including the at least one packet of the first MPEG-2 transport stream, the method comprising the
5 steps of:

6 assigning a unique designator to the source of the first MPEG-2 transport stream;
7 creating a transport stream source indicator signal that includes the unique designator
8 associated with the at least one packet of the first MPEG-2 transport stream;
9 multiplexing the at least one packet of the first MPEG-2 transport stream with packets from at
10 least a portion of a second MPEG-2 transport stream to create the multiplexed signal; and
11 transmitting to the external conditional access module the transport stream source indicator
12 signal in conjunction with the multiplexed signal, wherein transmission of the transport stream source
13 indicator signal, by the unique designator, indicates the source of the at least one packet as the source
14 of the first MPEG-2 transport stream.

1 12. The method of claim 11, further including the step of decrypting, in the external conditional
2 access module, the at least one packet based on the source of the first MPEG-2 transport stream.

1 13. The method of claim 12, further including the step of transmitting the decrypted at least one
2 packet from the external conditional access module to the host terminal.

1 14. A external conditional access module that can decrypt, based on a unique designator that
2 indicates a source of a data packet, data packets from at least one packetized data stream within an
3 incoming multiplexed signal comprised of data packets from more than one packetized data stream,
4 the external conditional access module comprising:

5 a host terminal interface for receiving the incoming multiplexed signal from a host terminal,
6 for transmitting an outgoing multiplexed signal to the host terminal, and for communicating the
7 unique designator for each data packet in both the incoming multiplexed signal and the outgoing
8 multiplexed signal;

9 a de-multiplexer for de-multiplexing the incoming multiplexed signal into data packets
10 associated with the at least one packetized data stream based on the unique designator associated with
11 each data packet;

12 a controller for determining if decryption is allowed for the data packets associated with the
13 least one packetized data stream and for controlling decryption parameters;

14 at least one decryptor for decrypting, if decryption is allowed, the data packets associated with
15 the at least one packetized data stream using decryption parameters for the at least one packetized data
16 stream; and

17 a multiplexer for multiplexing the data packets, including those that were decrypted and those
18 for which decryption was not allowed, into the outgoing multiplexed signal.

1 15. The method of claim 14, wherein the data packets and the packetized data stream are in a
2 format compliant with one of Moving Picture Experts Group type 2 (MPEG-2) standard, Moving
3 Picture Experts Group type 4 (MPEG-4) standard, Asynchronous Transfer Modulation (ATM)
4 standard, and Internet Protocol (IP) standard.

1 16. The method of claim 14, further comprising an encryptor for encrypting the data packets
2 associated with the at least one packetized data stream.

1 17. The method of claim 16, wherein the encryption provides copy protection for the data packets
2 associated with the at least one packetized data stream.

1 18. A host terminal that provides a multiplexed signal to an external conditional access module,
2 wherein the multiplexed signal includes data packets from at least two packetized data streams, the
3 host terminal comprising:

4 at least two tuners, each tuner for receiving one of the at least two packetized data streams;

5 and

6 a multiplexer for combining data packets from the at least two packetized data streams into
7 the multiplexed signal, for assigning a unique indicator that indicates which tuner received the
8 packetized data stream associated with the data packets, for transmitting the multiplexed signal to the
9 external conditional access module, and for communicating the unique designator associated with
10 each data packet to the external conditional access module.

1 19. The host terminal of claim 18, wherein the data packets and the packetized data stream are in
2 a format compliant with one of Moving Picture Experts Group type 2 (MPEG-2) standard, Moving
3 Picture Experts Group type 4 (MPEG-4) standard, Asynchronous Transfer Modulation (ATM)
4 standard, and Internet Protocol (IP) standard.

1 20. The host terminal of claim 18, further comprising a demultiplexer for receiving an output
2 signal from the external conditional access module, for de-multiplexing the output signal, and for
3 providing the at least two packetized data streams as separate packetized data streams.

1 21. In a system with a plurality of packetized data streams, a method of designating a source of a
2 first packetized data stream within a multiplexed signal including at least a portion of the at least one
3 packetized data stream, the method comprising the steps of:
4 assigning a unique designator to the source of the at least one packetized data stream;
5 multiplexing at least the portion of the at least one packetized data stream with at least a
6 portion of a second packetized data stream to create the multiplexed signal; and
7 transmitting the unique designator in conjunction with the multiplexed signal, wherein
8 transmission of the unique designator indicates the source of the portion of the multiplexed signal as
9 the source of the at least one packetized data stream.

1/5

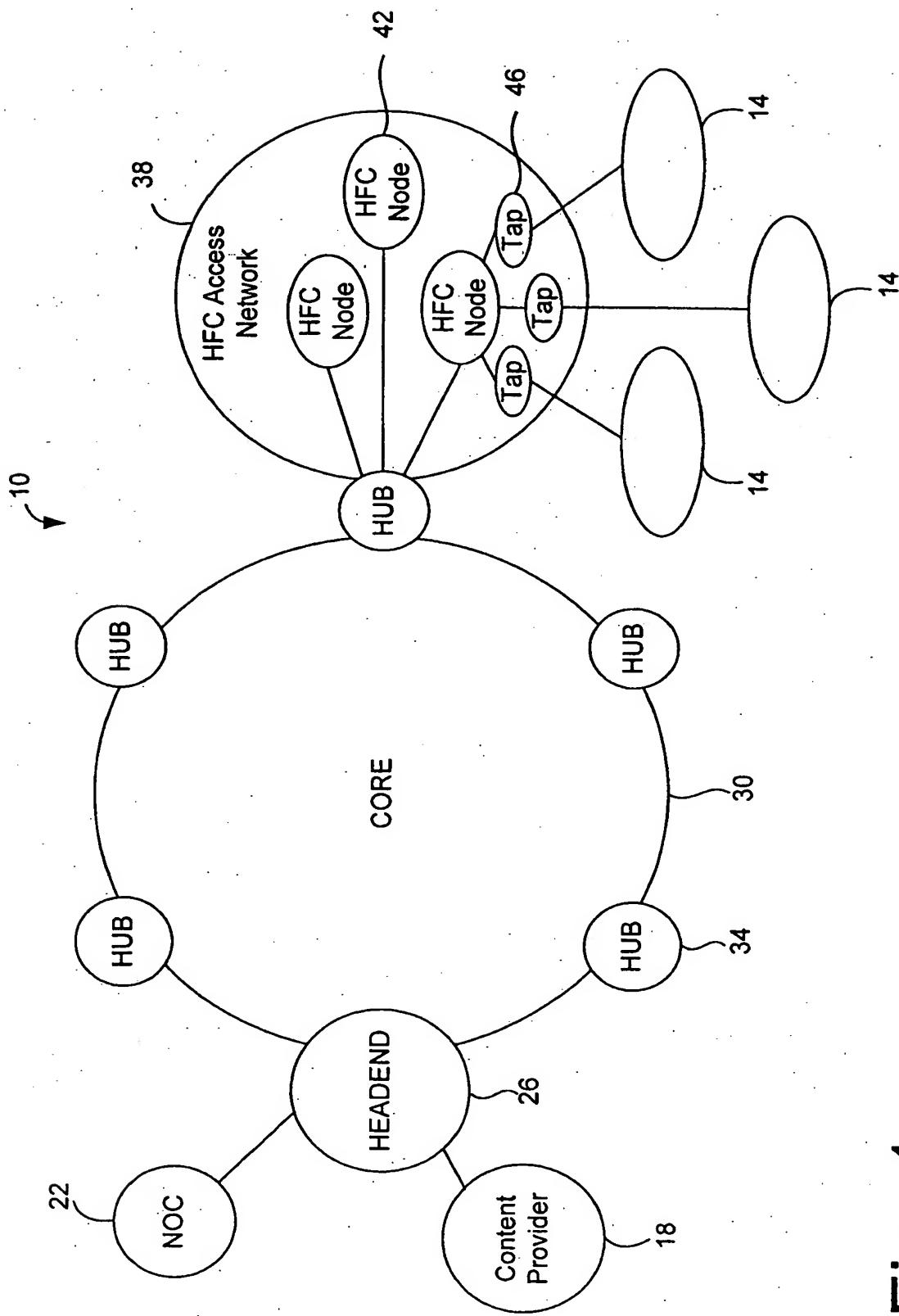


Fig. 1

2/5

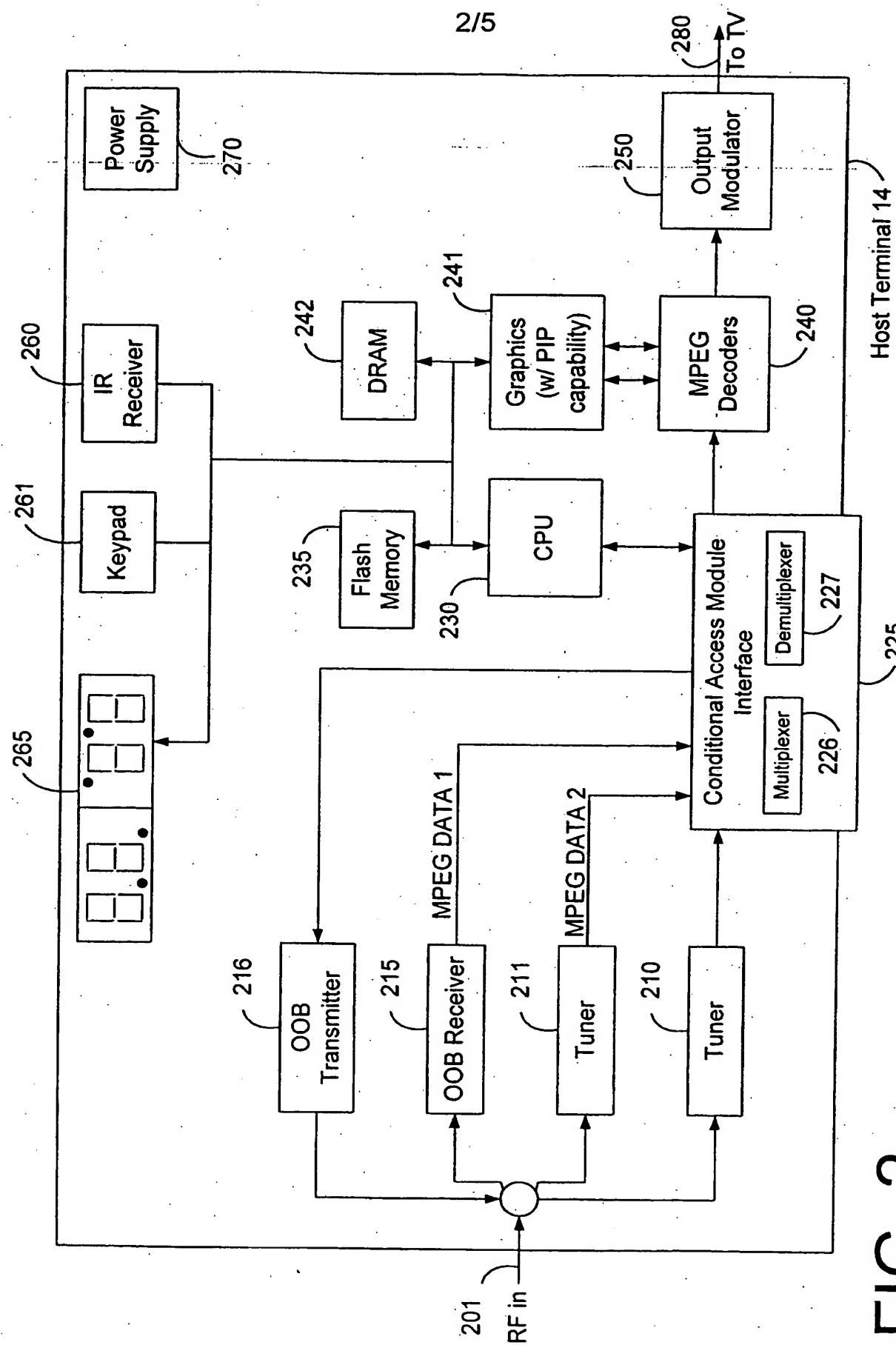
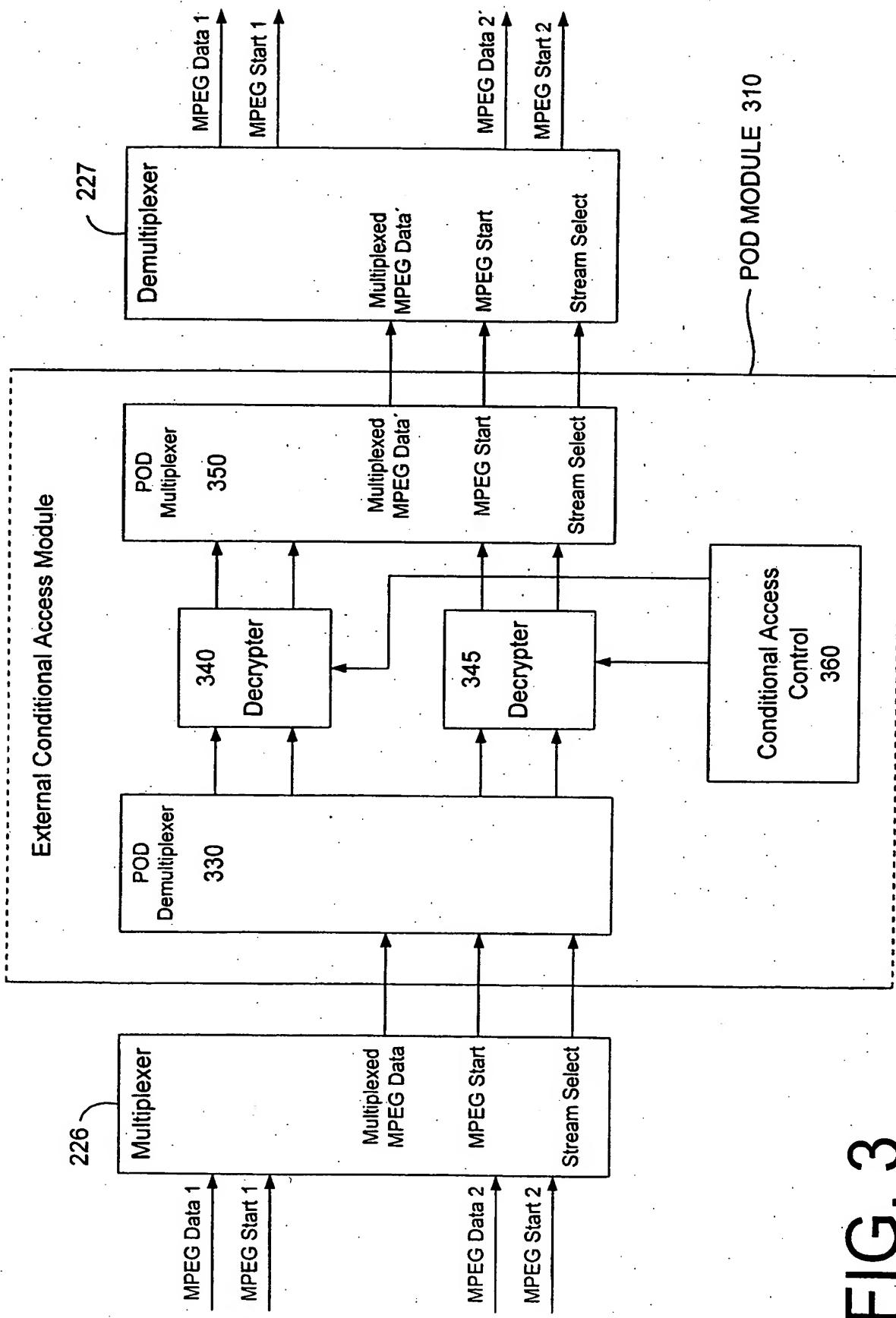


FIG. 2

3/5



4/5

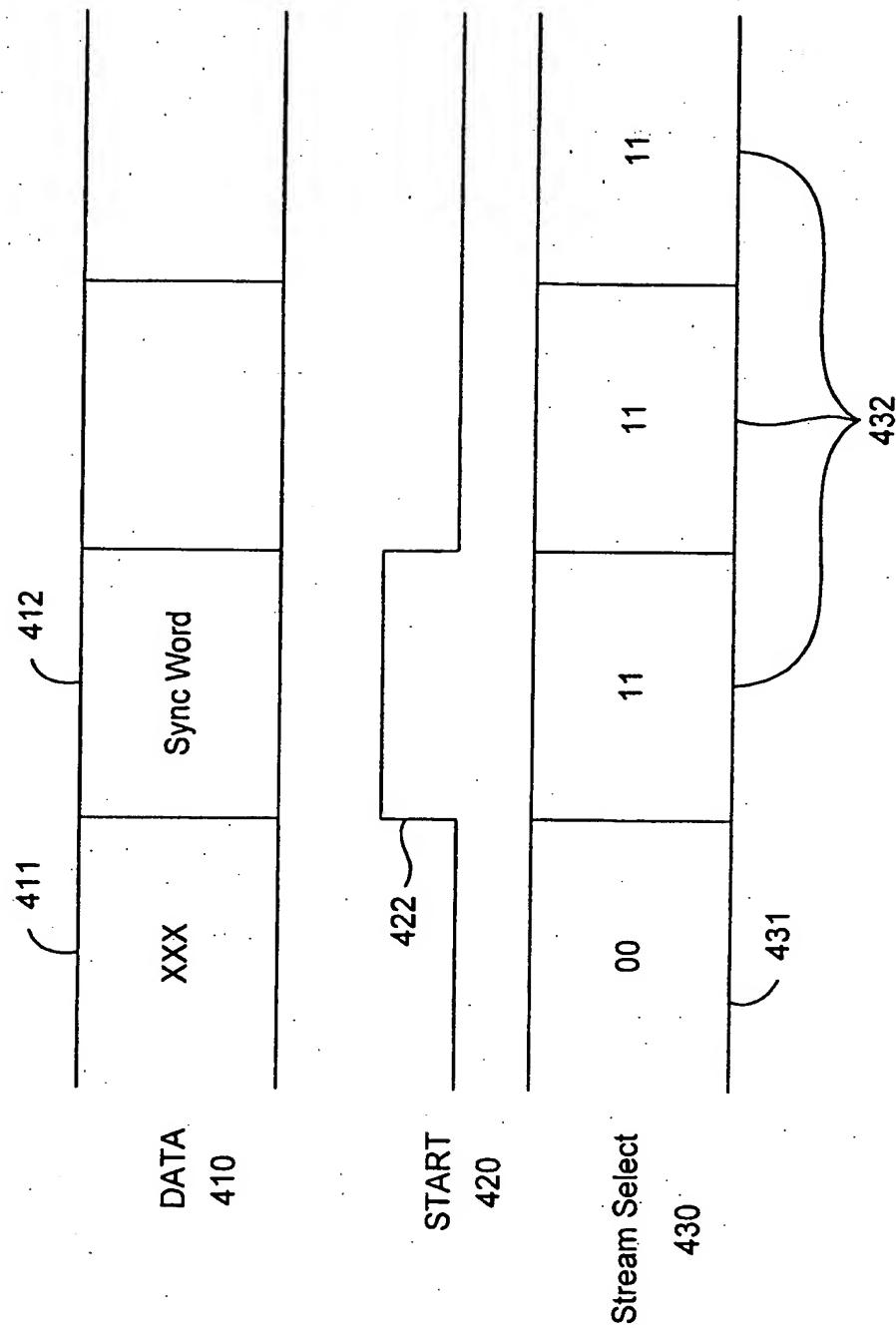


FIG. 4

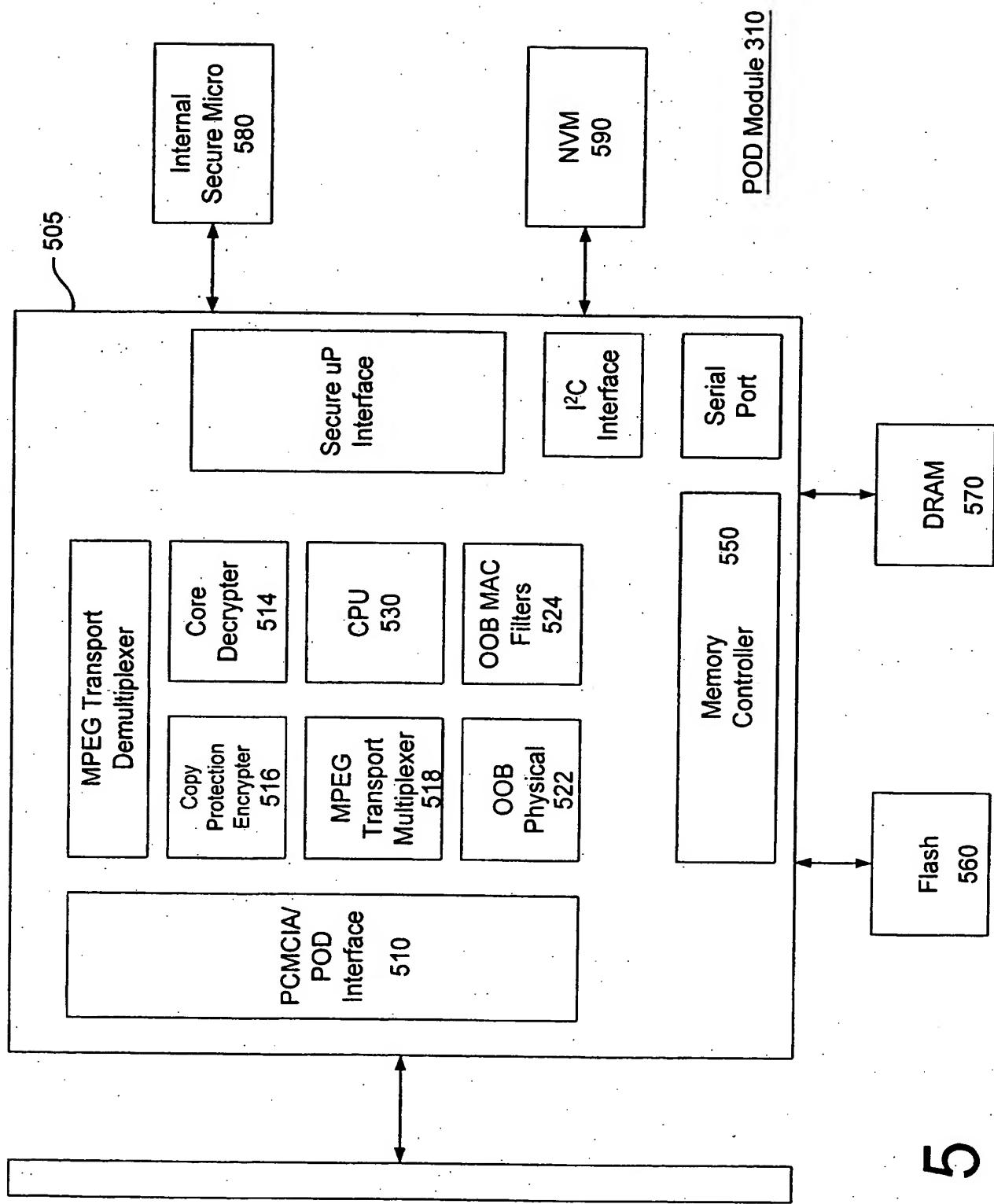


FIG. 5

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
14 June 2001 (14.06.2001)

PCT

(10) International Publication Number
WO 01/43444 A3

(51) International Patent Classification⁷: H04N 5/00 (74) Agents: BARNHARDT, Hubert, J., III et al.; Scientific-Atlanta, Inc.; Intellectual Property Department (4.3.517), 5030 Sugarloaf Parkway, Lawrenceville, GA 30044 (US).

(21) International Application Number: PCT/US00/33518 (22) International Filing Date: 12 December 2000 (12.12.2000)

(25) Filing Language: English (26) Publication Language: English (30) Priority Data: 60/170,344 13 December 1999 (13.12.1999) US (71) Applicant: SCIENTIFIC-ATLANTA, INC. [US/US]; Hubert J. Barnhardt III, Scientific-Atlanta, Inc., Intellectual Property Department, 5030 Sugarloaf Parkway, Lawrenceville, GA 30044 (US).

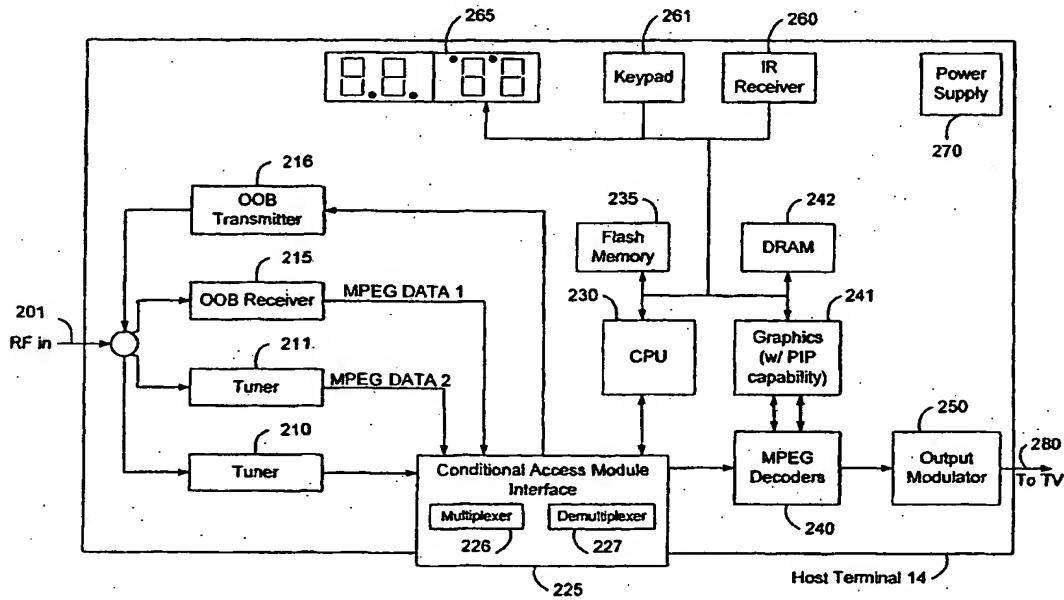
(72) Inventors: BACON, Kinney; 2820 Springtime Court, Lawrenceville, GA 30043 (US). HAMMOND, Maynard; 732 Silver Falls Drive, Lawrenceville, GA 30045 (US).

(81) Designated States (national): BR, CA, JP. (84) Designated States (regional): European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published: — with international search report (88) Date of publication of the international search report; 1 November 2001

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF IDENTIFYING MULTIPLE DIGITAL STREAMS WITHIN A MULTIPLEXED SIGNAL



WO 01/43444 A3

(57) Abstract: In a subscriber television system with a host terminal, the present invention allows the identification of the individual packets from two separate MPEG transport streams that have been multiplexed together for decoding by a single external conditional access or point-of-deployment (POD) module. The decoding of individual packets from two separate MPEG transport streams supports the use of multiple tuner host terminals for such functions as picture-in-picture (PIP) program viewing and the viewing of one program while recording a second program.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/33518

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 HO4N5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 HO4N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 838 873 A (BRIDGEWATER KEVIN ELLIOTT ET AL) 17 November 1998 (1998-11-17) abstract; figure 1	1-8, 21
Y	WO 99 57889 A (SONY ELECTRONICS INC) 11 November 1999 (1999-11-11) the whole document	9-20
A	US 5 936 660 A (GURANTZ ITZHAK) 10 August 1999 (1999-08-10) abstract; figure 3	1-8, 21
A	EP 0 893 921 A (SCIENTIFIC ATLANTA) 27 January 1999 (1999-01-27) abstract	1-21
		-/-

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 May 2001	28/05/2001
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Authorized officer La, V

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/33518

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 425 101 A (SHELDICK WAYNE S ET AL) 13 June 1995 (1995-06-13) column 14, line 10 - line 33 abstract; figure 8 -----	1-21

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/33518

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 5838873	A 17-11-1998	AU 3209497 A		05-01-1998
		BR 9709420 A		10-08-1999
		CN 1226357 A		18-08-1999
		EP 0903035 A		24-03-1999
		JP 2000511019 T		22-08-2000
		WO 9746007 A		04-12-1997
		AU 3150797 A		05-01-1998
		AU 3150897 A		05-01-1998
		AU 716349 B		24-02-2000
		AU 3213297 A		05-01-1998
		AU 3213397 A		05-01-1998
		BR 9709409 A		10-08-1999
		BR 9709410 A		10-08-1999
		BR 9709494 A		10-08-1999
		BR 9709508 A		10-08-1999
		CN 1226354 A		18-08-1999
		CN 1226359 A		18-08-1999
		CN 1226355 A		18-08-1999
		CN 1226356 A		18-08-1999
		EP 0903033 A		24-03-1999
		EP 0903034 A		24-03-1999
		EP 0903036 A		24-03-1999
		EP 0903038 A		24-03-1999
		JP 2000511020 T		22-08-2000
		JP 2001502854 T		27-02-2001
		JP 2000512095 T		12-09-2000
		PL 330219 A		10-05-1999
		TR 9802484 T		22-03-1999
		WO 9746008 A		04-12-1997
		WO 9746017 A		04-12-1997
		WO 9746009 A		04-12-1997
		WO 9746010 A		04-12-1997
		US 5844595 A		01-12-1998
		US 5844478 A		01-12-1998
		US 5754651 A		19-05-1998
		US 5933500 A		03-08-1999
WO 9957889	A 11-11-1999	US 6154206 A		28-11-2000
		AU 3882899 A		23-11-1999
		EP 1078510 A		28-02-2001
US 5936660	A 10-08-1999	EP 0945017 A		29-09-1999
		WO 9826593 A		18-06-1998
EP 0893921	A 27-01-1999	NONE		
US 5425101	A 13-06-1995	AU 1263995 A		19-06-1995
		CA 2177138 A		08-06-1995
		EP 0730802 A		11-09-1996
		JP 9506224 T		17-06-1997
		WO 9515632 A		08-06-1995